A QUALITY OF CARE ASSESSMENT OF THE MANAGEMENT OF OBSTETRIC HAEMORRHAGE IN THE PENINSULA MATERNAL AND NEONATAL SERVICES.

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This dissertation was conducted while working as a registrar in the Department of Obstetrics and Gynaecology at the University of Cape Town, as required by the College of Medicine of South Africa for admission into the fellowship of Obstetrics and Gynaecology of South Africa.

This is to certify that this dissertation is the original work of the candidate.

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ABSTRACT: A QUALITY OF CARE ASSESSMENT OF THE MANAGEMENT OF OBSTETRIC HAEMORRHAGE IN THE PENINSULA MATERNAL AND NEONATAL SERVICES

Introduction: In South Africa obstetric haemorrhage is the third most common cause of maternal deaths. In addition to maternal mortality audits, quality of care audits using criterion based audit methodology provides useful information.

Aim: The aim of this study was to audit the management of all women with severe obstetric haemorrhage in the Peninsula Maternal and Neonatal Services in order to improve management.

Methods: A descriptive retrospective audit was conducted during the period August 2006 to August 2007 using a criterion based audit methodology. Cases of severe obstetric haemorrhage were identified prospectively.
Folders were reviewed and data collection sheets utilized to:
1. Describe the demographics and causes of obstetric haemorrhage in the Peninsula Maternal and Neonatal Services,
2. Measure the case fatality ratio,
3. Describe the management of women with severe obstetric haemorrhage with reference to that prescribed in the South African National Guidelines (2002-2004),
4. Score the management provided by the Peninsula Maternal and Neonatal Services using a shorter checklist devised from the National Guidelines.

Results: During the period August 2006–August 2007 145 cases were identified giving a rate of 3.7 per 1000 deliveries. It was found that pre-eclampsia (20.7 %) and antepartum haemorrhage (23.4 %) were the most common complications in the current

pregnancy, whereas a history of previous caesarean section was the most frequent past obstetric complication. Placental abruptions (27.6 %) followed by uterine atony (25.5 %) were the most common causes of obstetric haemorrhage. It was found that 50.3 % of deliveries associated with obstetric haemorrhage occurred at a tertiary hospital and emergency caesarean sections accounted for 41.4 % of deliveries. There was only one obstetric death directly due to obstetric haemorrhage giving a case fatality ratio of 0.69 %. Total abdominal hysterectomies were performed in 2 patients and there were 35 stillbirths as a result of placental abruptions. In terms of management, 21 of the 145 patients (14.5 %) received prophylactic haematinics, treatment was not instituted in 29.6 % of anaemic patients and only 59.3 % of patients had their haemoglobin checked in labour. It was found that 49.7 % of patients had only one intravenous cannula inserted as part of resuscitation. Six of the seven cases of uterine rupture were not correctly diagnosed whereas all other cases resulting from uterine atony, retained placenta and caesarean associated haemorrhage were correctly diagnosed. There were no cases of haemorrhage secondary to cervical tears. On scoring the management it was found that 78.6 % of patients received adequate care, 20.7 % received intermediate care and 0.7 % received inadequate care.

Conclusion: Strengths and deficiencies in the management of obstetric haemorrhage in the PMNS were identified by this audit. The checklist was easy to administer and needs to be evaluated in other settings, for example in an area with a higher maternal mortality rate due to obstetric haemorrhage.

A QUALITY CARE ASSESSMENT OF THE MANAGEMENT OF OBSTETRIC HAEMORRHAGE IN THE PENINSULA MATERNAL AND NEONATAL SERVICES

BACKGROUND TO STUDY

Obstetric haemorrhage is a very common cause of maternal death and morbidity. Most deaths are preventable by appropriate management of this complication. Sometimes, however, a preventable and potentially manageable condition is fatal in developing countries where access to good obstetric facilities, transport and blood transfusions is limited.

One way of improving management is to audit the management of all women with severe obstetric haemorrhage (not just deaths). A methodology which is extremely useful is a "criterion based audit" which evaluates management against an established standard. A quality of care checklist for obstetric haemorrhage management would be particularly useful in South Africa. In South Africa obstetric haemorrhage (antepartum and postpartum) accounts for 13.4 % of obstetric deaths and is the third most common cause of maternal deaths [(1)]. It is important to note that in South Africa 92.5% of deaths secondary to obstetric haemorrhage were as a result of hypovolaemic shock[(2)]. The most recent report on the Confidential Enquiries into Maternal Deaths in South Africa found

that postpartum haemorrhage and anaesthetic related deaths occurred more commonly at level 1 hospitals. This delay in referral is concerning as it reflects lack of recognition of the magnitude of the problem, lack of resuscitation skills or lack of transport [1].

A checklist could evaluate management in an area where obstetric haemorrhage is an unacceptably common cause of maternal mortality and morbidity and compare it with an area where this complication is less common. In this way it would identify service deficiencies which need improvement and also identify the factors that favour survival. The focus of the study is to audit the quality of management of obstetric haemorrhage in the Peninsula Maternal and Neonatal Services (PMNS), Cape Town, with reference to national management guidelines and using a purpose designed checklist.

LITERATURE REVIEW

The World Health Organisation estimates that globally there are 14 million obstetric haemorrhages per year. Of these, postpartum haemorrhage is the single most common cause of maternal deaths worldwide [3]. These statistics emphasize the importance of recognition and appropriate management of postpartum haemorrhage.

Postpartum haemorrhage is defined by the World Health Organization as blood loss greater than 500 ml. Primary postpartum haemorrhage is diagnosed when this blood loss

occurs within 24 hours of delivery. Secondary postpartum haemorrhage is defined as excess blood loss between 1 and 42 days after delivery. It is considered to be severe if postpartum blood loss is in excess of 1000 ml and massive blood loss is greater than 1500 ml. However there is controversy regarding classifications as blood loss is often underestimated and assessed retrospectively. It may also not represent the clinical situation.

In an acute emergency, blood loss is often estimated visually. This estimation is difficult and inaccurate. A study conducted in Singapore comparing visual estimation with laboratory determination of measured blood loss found that visual blood loss was often inaccurate especially at the extremes of measured blood loss and that primary postpartum haemorrhage could easily be unrecognised unless the patient had signs of hemodynamic instability[4]. The physiological adaptation of the cardiovascular system in pregnancy (such as an increase in plasma volume from 2600 ml to 3850 ml ,increase in red cell mass from 1400 ml to 1640 ml and rise in circulating blood volume from 4000ml to 5500 ml) provides a compensatory reserve and hence the healthy pregnant woman can tolerate blood losses of up to 1000ml.Signs of shock (such as tachycardia, hypotension and decreased urine output) which present earlier in a non pregnant woman are masked by these adaptations and hypovolaemia is often not recognised and treatment delayed.

Queen Charlotte's Hospital in London in 2006 undertook an exercise to improve visual estimation of blood loss. They provided clinical reconstructions of blood loss (soiled versus saturated sanitary towels, full kidney dish, and postpartum haemorrhage on the

bed only versus spillage onto the floor) and took photographs to provide a pictorial guideline. Different staff members, including midwives and doctors, were asked to estimate blood loss and then after the exercise compare their answers. Significant underestimation of blood loss was demonstrated in all professional groups [5]. It would be more useful to consider not only estimated blood loss but also the clinical condition of the patient when assessing for postpartum haemorrhage. This would include pulse, blood pressure, assessment of urine output and peripheral capillary filling.

It is important to understand the normal physiology of labour in the management of postpartum haemorrhage. The myometrium is composed of an interlacing network of muscular fibres. The blood vessels that supply the placental bed pass through this network. Thus myometrial contraction is the most important factor for both placental separation and haemostasis by constriction of these blood vessels. This mechanism is referred to as the 'physiological sutures" or 'living ligatures". There is also a physiological increase in clotting factors during labour and this helps to control blood loss after the placenta has separated [6].

Causes of antepartum haemorrhage include placenta praevia, abruptio placenta and local lesions such as vaginal tears or cervicitis. There is often considerable overlap between antepartum and postpartum haemorrhage, for example antepartum haemorrhage could be secondary to abruptio placenta and post delivery abruptions can result in uterine atony.

There are various causes of postpartum haemorrhage of which uterine atony is the commonest [3]. Uterine atony is often a result of a hyperstimulated uterus, overdistended uterus, prolonged labour, placental abruptio, retained placenta and retained products of conception. Other causes of postpartum haemorrhage include trauma such as vaginal and perineal tears, episiotomy, instrumental deliveries, and cervical tears and more dramatically a ruptured uterus. Rarer causes of postpartum haemorrhage include uterine inversion, coagulopathy and amniotic fluid embolism. Significant haemorrhage can also occur during caesarean section either due to atony, difficult surgery secondary to adhesions or placenta praevia.

In South Africa, during the period 2002 – 2004 the causes of maternal deaths were reviewed in a confidential report. Obstetric haemorrhage was subdivided into various causes. It was found that placental abruptions were the most common cause of antepartum haemorrhage (39.6 %) followed by placenta praevia (10.1 %). The largest cause of postpartum haemorrhage was uterine rupture (26.8 %) followed by uterine trauma (24.9 %).This group included a small group with serious vaginal trauma and a larger group of women with bleeding during or after caesarean section. The other causes of postpartum haemorrhage included uterine atony (23.6 %), retained placenta (21.4 %), morbidly adherent placenta (1.9 %) and inverted uterus (1.3 %) [1].

It is important to identify risk factors for postpartum haemorrhage in the antenatal period in order to anticipate and appropriately prevent and manage haemorrhage. These include multiparity, polyhydramnios, multiple pregnancy, previous caesarean section, previous

uterine surgery, uterine fibroids and a previous history of postpartum haemorrhage [7]. It is also important to detect and treat anaemia antenatally. Intrapartum risk factors include prolonged labour, induction of labour and the use of oxytocin.

A case control study in Zimbabwe was undertaken to determine risk factors for postpartum haemorrhage in a developing country. Advanced maternal age was found to be independently associated with a risk of postpartum haemorrhage – women 35 years or more at delivery had a two and a half times greater risk of haemorrhage post delivery than younger women. Women with a previous history of postpartum haemorrhage, stillbirth or neonatal death had twice the risk of postpartum haemorrhage than women with no such history. Antenatal hospitalisation and anaemia in the current pregnancy were also independent associations. Of note was that occipito-transverse or posterior fetal head positions were associated with a tenfold greater relative risk for postpartum haemorrhage. A prolonged first or second stage of labour was associated with relative risks of 2.9 and 2.6 respectively. It is interesting that in this study high parity was not associated with an increased risk of postpartum haemorrhage [8].

Active management of the third stage of labour is recommended as part of clinical guidelines in hospital settings for prevention of postpartum haemorrhage. A randomised controlled trial conducted in Hinchingbrooke Healthcare NHS trust and completed in 1995 was published in the Lancet in 1998[9]. Active management versus expectant management of the third stage of labour was compared. Active management included routine prophylactic administration of an uterotonic agent, early cord clamping and

cutting and controlled cord traction. The rate of postpartum haemorrhage was significantly lower with active than with expectant management: 51 of 748 (6.8 %) versus 126 of 764 (16.5 %) with a relative risk of 0.41.

The management of postpartum haemorrhage involves initial assessment of quantity of haemorrhage and, if there are any signs of shock (tachycardia, low blood pressure, oliguria etc.), resuscitation is extremely important. This involves at least two intravenous infusions with large bore cannulas and rapid infusion of crystalloids or colloid. Emergency O-negative blood may be necessary while awaiting cross-matched blood. Fresh frozen plasma may be required if a disseminated intravascular coagulopathy is suspected. The uterus should be massaged to promote contraction and the cause of the postpartum haemorrhage determined. A retained placenta or products of conception should be removed, if present, and any lacerations repaired if it is the cause of bleeding [6, 10].

There are various treatment modalities for an atonic uterus. Initial management is mechanical. This refers to bimanual compression of the uterus which could be life-saving for example when transferring a patient or prior to the use of pharmacological agents. Uterotonics encourage uterine contractility and include ergometrine, oxytocin and prostaglandins including misoprostol and prostaglandin F2 alpha. Haemostatic agents influence the clotting cascade (such as tranexamic acid and recombinant factor VII). Surgical interventions include tamponade by packing or intrauterine catheter insertion (Rusch catheter) [6].

In Bangladesh, which is a developing country, control of postpartum haemorrhage was achieved within 15 minutes of inserting a condom catheter [(11)]. A sterile rubber catheter fitted with a condom was placed in the uterus and the catheter inflated with 250 – 500 ml normal saline. This intervention was only used when postpartum haemorrhage, secondary to atonicity or morbid adhesion of the placenta, could not be controlled by uterotonics or a surgical procedure.

Blood vessel ligation/uterine devascularisation, uterine compression sutures such as the B-Lynch suture and finally hysterectomies are other surgical possibilities. The B Lynch suture was first performed by Mr Christopher B-Lynch in a woman who declined consent to a emergency hysterectomy. It is a brace suture which aims to exert continuous vertical compression on the vessels. Many modifications of this suture has been performed.The B-Lynch has been recommended by the Royal College of Obstetricians and Gynaecologists and the Cochrane Database of systematic reviews and thus far no serious adverse effects have been reported. Radiological techniques such as selective radiological embolisation of the bleeding vessel are a therapeutic option in developed countries when the bleeding is not life-threatening. A skilled radiologist is required for this intervention [(6)].

Misoprostol is a promising drug that can be easily administered rectally. A single blinded randomised trial was conducted in South Africa by Hofmeyr et al [(12)]. This trial compared rectal misoprostol 800 micrograms with a regime of intramuscular syntrometrine plus an

oxytocin infusion for the management of postpartum haemorrhage. The trial was stopped prematurely as misoprostol showed benefit with respect to the cessation of bleeding within 20 minutes and no additional medical intervention was required. No difference was however demonstrated with regards to maternal morbidity, mortality and hysterectomy. This was a rather small trial. It was not blinded for the practitioner thus bias in interpreting the results cannot be excluded.

Data regarding the use of prostaglandins in the prevention of postpartum haemorrhage is conflicting. A systematic review in 2004 by Gulmezoglu et al published on the Cochrane Database does not suggest a substantive reduction in the rate of postpartum haemorrhage when prostaglandins are used prophylactically[13]. A recent trial by Derman randomised 1620 low risk women in India to receive oral misoprostol(n = 812) or placebo (n = 808) after delivery[14]. It was found that oral misoprostol caused a significant reduction in the rate of acute postpartum haemorrhage 12% to 6.4% RR 0.53 and acute severe postpartum haemorrhage 1.2% to 0.2% RR 0.2. The women receiving misoprostol had a higher rate of side effects such as fever and shivering. These women all delivered in a community home birth setting and it is noted that oxytocin is the uterotonic drug of choice for prevention in hospital practice. Misoprostol is, however, a good option in resource-poor settings because of its low cost, ease of administration, stability and positive safety profile.

In the case of a retained placenta the WHO currently recommends the injection of uterotonic agents via the umbilical vein. The Cochrane database supports this statement.

Umbilical vein injection of saline plus oxytocin versus expectant management showed a 13 % risk reduction in the incidence of manual removal of placenta. However this benefit was not statistically significant [15]. Placenta accreta which was previously considered to be rare has increased in prevalence due to the rise in the caesarean section rate. It is a condition in which all or part of the placenta is adherent to the uterine wall because of myometrial invasion by chorionic villi. There is an association with placenta praevia and advanced maternal age and this condition causes significant morbidity and mortality. It has been estimated that after four caesarean sections the rate of placenta accreta could be as high as 67 %[7].

The South African Saving Mothers report (1999-2001) identified the following issues with regards to the management of postpartum haemorrhage:

1. The potency of misoprostol as an oxytocic drug when inducing labour is underestimated
2. The posterior surface of the uterus is not routinely inspected when a caesarean section is performed and
3. The decision to perform a hysterectomy is often made too late.

We often attempt to preserve fertility but a hysterectomy can be life saving when the haemorrhage is intractable. Also noted was a recommendation for ongoing education and professional development at level 1 and 2 hospitals [2].

A report published in July 2006 in South Africa (Saving Mothers 2002 –2004) found that 83% of deaths secondary to postpartum haemorrhage and 76% secondary to antepartum

haemorrhage were clearly avoidable. The following problems were identified: lack of emergency blood, lack of appropriately skilled personnel especially at level one hospitals, lack of adherence to specific protocols, inappropriate use of oxytocin and lack of transport resulting in unstable patients being kept at the incorrect level of care[1].

Some of the recommendations made during the confidential enquiry include:

1. Protocols on the management of important conditions causing maternal deaths must be available in all institutions. All medical personnel should receive training regarding these protocols. This includes adequate resuscitation and management of obstetric haemorrhage.

2. There should be fixed criteria for referral and referral routes.

3. Availability of emergency transport.

4. There should be adequate staffing and equipment at different levels of care.

5. Blood should be available at every institution where caesarean sections are performed. Staff should be trained regarding the active management of the third stage of labour and appropriate antenatal referral of women at risk of postpartum haemorrhage to the appropriate level of care.

6. Training regarding the correct use of the partogram should be provided. This would alert doctors or midwives as prolonged labour increases the risk of postpartum haemorrhage.

7. Educating and empowering women and hence improving reproductive health.

In a developing country like South Africa there are many avoidable factors that contribute to maternal mortality and morbidity. These include patient-related factors, care or management by medical personnel and administrative or organizational factors. During the time period 2002 – 2004 the avoidable factors were as follows:

1. Patient orientated - 43.9 %
2. Administrative factors - 32.1 %
3. Health worker related problems - 24 %

(22.3 % of these were secondary to inadequate resuscitation.)

In South Africa the National Confidential Enquiry focuses on an analysis of death. Audits can be conducted on a specific clinical condition which may have a good or poor outcome.

An audit is a quality improvement process that seeks to improve patient care and outcomes by a systematic review of care against explicit criteria. This is in order to implement change or to achieve a target. It is of note that "criteria" do not necessarily prescribe all the elements of management but rather encompasses those practices which:

- are essential rather than optional
- are realistic practices given the capacity of a facility in terms of staff and resources
- can be audited using case notes
- And for which sound research and evidence exists [16].

Collection of data via an audit is a confidential exercise.

It is thus a potentially powerful way to improve the care of women who develop complications during pregnancy. A criterion based audit of obstetric haemorrhage in South Africa could evaluate management against provincial or national guidelines [17, 1].

The National Guidelines (found as an appendix to the obstetric haemorrhage chapter in the recent report[1]) on the management of obstetric haemorrhage clearly state the various steps but gives no indication of the time periods in which these steps should be undertaken. In an effort to prevent or reduce maternal mortality research has been conducted to evaluate the delays that affect the interval between the onset of an obstetric complication and its outcome. Three phases of delay were described:

1. Delay in decision - making or seeking care (factors include distance, cost, sociocultural factors etc.).
2. Delay in accessing care.
3. Delay in adequate care which refers to shortages of staff, equipment, trained and competent personnel [18].

It would be interesting to note the times of arrival at a healthcare facility and times that management was instituted during this audit.

The development of a quality of management checklist would enable us to assess and compare the quality of care in different settings. The quality of care for severe obstetric haemorrhage was evaluated in three French regions [19]. A checklist was developed by an expert committee. It consisted of eight criteria including management and appropriate time periods. Cases were reviewed and according to the checklist classified into

appropriate, inadequate and mixed care. The expert committee classified care as appropriate when all the criteria of the checklist were met and care was inadequate when the majority of criteria were not met. The mixed category referred to cases where the expert opinion was less clear cut.

A criterion based audit on obstetric haemorrhage has to date not been performed in South Africa and it would be interesting to compare findings in a developing country with those found in developed areas.

AIM

The aim of this study is to audit the quality of management of severe obstetric haemorrhage in the Peninsula Maternal and Neonatal Services with reference to the South African national guidelines and a purpose designed checklist.

SPECIFIC OBJECTIVES

1. To describe the demographic and obstetric profile of women with severe obstetric haemorrhage.
2. To describe the causes of severe obstetric haemorrhage.

3. To measure the case fatality rate from severe obstetric haemorrhage.

4. To describe the management of women with severe obstetric haemorrhage with reference to that prescribed in the South African national guidelines (Saving Mothers report 2002-2004).

5. To score the management using a checklist derived from the above guideline.

RESEARCH DESIGN AND METHODOLOGY

Study design

A descriptive retrospective audit conducted during the time period August 2006 to August 2007. A criterion based audit methodology was used. Cases were identified prospectively and the folders were analysed retrospectively. The frequencies and statistics were calculated using the program called Epi info.

Study setting and population

The study evaluated women with severe obstetric haemorrhage who were referred to hospital facilities in the PMNS. These facilities include Groote Schuur Hospital, Mowbray Maternity Hospital and New Somerset Hospital. In the PMNS blood loss was

measured either by visual estimate or with the use of a measuring jug wherein blood clots were placed.

The Peninsula Maternal and Neonatal Services (PMNS) refer to the tiered regionalised system formed to provide obstetric care to women in the Southern suburbs of Cape Town according to defined referral criteria. Primary care is provided by Midwife Obstetric Units (in suburbs such as Mitchell's Plein, Gugulethu, Khayelitsha, Hanover Park and Vanguard Drive). The secondary hospitals, Mowbray Maternity hospital and New Somerset Hospital, serve as referral centres for these midwife –run facilities. Sub-specialist care is provided by the tertiary hospital, Groote Schuur Hospital. All women with antepartum and postpartum haemorrhage were referred from the Midwife Obstetric Units to these hospitals.

Inclusion criteria for causes of severe obstetric haemorrhage:

1. Gestation considered viable by the WHO i.e. weight greater than 500g or gestation greater than 22 weeks.
2. Postpartum haemorrhage within 24 hours of delivery.
3. Obstetric haemorrhage greater / equal to 1000 ml and/or
4. Blood loss sufficient to require the following measures:
    - blood transfusion
    - manual removal /evacuation of uterus in theatre
    - re –look laparotomy
    - hysterectomy

Exclusion criteria:

Severe haemorrhage from miscarriages

(I.e. WHO definition < 500 g / = 22 weeks gestation).

Blood loss less than 1000ml.

Data collection

The research was conducted using a criterion based audit methodology.

Cases of severe obstetric haemorrhage were evaluated between the time periods August 2006 to August 2007. Relevant cases were identified prospectively from the delivery registers and Cradle computer delivery register. Estimated blood loss was documented in these registers and this allowed us to identify cases with severe obstetric haemorrhage.

Information was retrieved from folders as follows:

1. Completion of a data collection sheet describing the demographics and causes of obstetric haemorrhage in the cases evaluated (appendix 1).

2. Completion of a data collection sheet developed from the South African National Management guidelines to document the management provided, time intervals and any deficiencies (appendix 2).

3. The information pertaining to management in (2) was modified into a shorter user-friendly quality of care checklist which prescribed optimal time intervals to and between interventions as a component (appendix 3).

4. The management of obstetric haemorrhage in the PMNS was given a quality of care score according to the checklist. We defined management as adequate if the score was between 70 – 100%, 50- -70 % defined intermediate care and if the score was below 50 %, it was considered to be suboptimal.

ETHICAL AND LEGAL CONSIDERATIONS

There would be complete confidentiality regarding:

- Patients' names.
- Medical personnel involved.

The research was approved by the Department of Obstetrics and Gynaecology Research committee (Groote Schuur Hospital) and the management of the three hospitals. Ethical approval for this audit was provided by the University of Cape Town's Research and Ethics general permission for obstetric audit. This is in keeping with the Helsinki declaration [20].

RELEVANT DEFINITIONS

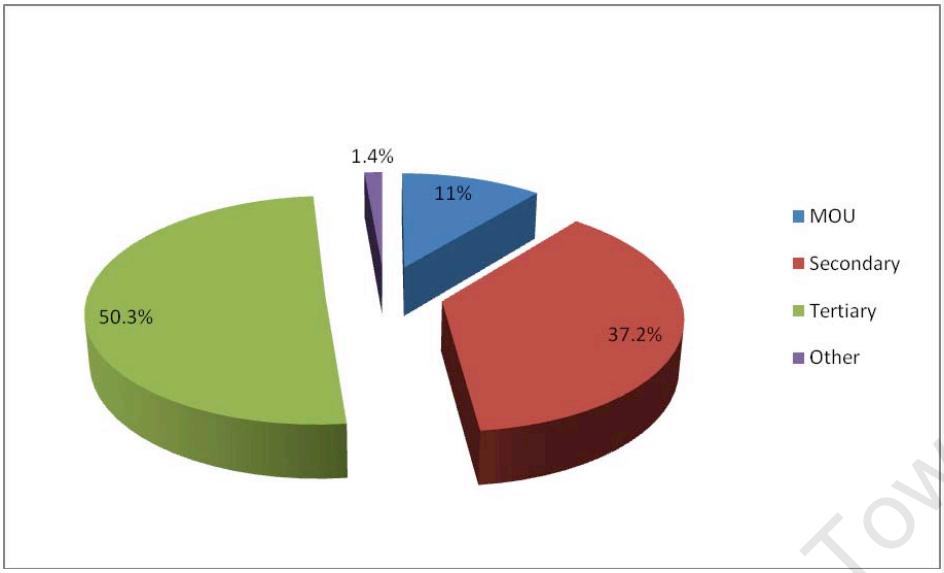
1. Anaemia was defined as a haemoglobin reading below 10 grams /dl.
2. Active labour was defined as having cervical dilatation of at least 3cm or more with complete effacement.
3. The second stage of labour is defined as the time period from reaching full cervical dilatation to the delivery of the baby
4. We defined morbidity as the end result being a hysterectomy, ventilation and ICU admission.
5. Emergency blood refers to O negative blood that is available on site for life threatening haemorrhage.
6. Cross matched blood refers to type specific blood that requires screening and it is only available in approximately 60 -90 minutes.
7. If a placenta has not separated from the uterus and is not delivered after 30 minutes it is referred to as a retained placenta.

RESULTS

All the folders of patients that attended Groote Schuur hospital and Mowbray Maternity hospital that met the study criteria were retrieved. New Somerset hospital does not record blood loss in their delivery records and many folders could not be found. We included all the cases from New Somerset hospital that were retrieved. Thus the total of 145 patients that met the criteria whose folders were found is an underestimate of obstetric haemorrhage in the PMNS during the period August 2006 to August 2007. All cases of haemorrhage occurring at the midwife obstetric units were referred on to one of the three hospitals. There were 38679 deliveries in the Peninsula Maternal and Neonatal Services during the study period, giving a rate of obstetric haemorrhage of 3.7 per 1000 deliveries.

FIGURE 1

PLACE OF DELIVERY (IN PERCENTAGES)



The highest percentage of deliveries occurred in tertiary institutions, 73 patients (50.3 %), as shown in Figure 1. This could be a reflection of a well functioning referral system where high risk individuals are managed at a specialist centre. There were 54 patients (37.2 %) that delivered at a secondary hospital and 16 patients (11 %) delivered at the midwife obstetric units. The lowest percentage of 1.4% (2 patients) refers to deliveries that occur in places other than a midwife obstetric unit or hospital. This includes deliveries that occur at home or on route to the hospital.

TABLE 1. AGE AND PARITY OF WOMEN WITH SEVERE OBSTETRIC HAEMORRHAGE

AGE	**NUMBER = 145**	**%**
< 20 years	**15**	**10.3 %**
20 – 34 years	**94**	**64.8 %**
≥ 35 years	**35**	**24.1 %**
unknown	**1**	**0.7 %**
PARITY BEFORE DELIVERY		
0	**36**	**24.8 %**
1 - 4	**104**	**71.7 %**
5 or more	**5**	**3.4 %**

In our study we found that 64.8 % of patients were between the ages of 20 and 34 years. Only 5 patients (3.4 %) were multiparous with five or more previous deliveries (Table 1).

TABLE 2. HIV STATUS OF WOMEN WITH SEVERE OBSTETRIC HAEMORRHAGE

HIV STATUS	**NUMBER = 145**	**%**
Positive	**30**	**20.7 %**
Negative	**95**	**65.5 %**
Declined	**20**	**13.8 %**

Of the 145 cases reviewed 20.7 % were HIV positive. It is interesting to note that only 13.8 % of patients in this study declined HIV testing after counselling.

The mean CD4 count was 419.97 with a minimum of 97 and a maximum of 983.

With regard to antenatal care 130 of the 145 patients (89.7 %) had previously attended antenatal clinics whereas 15 patients (10.3%) were unbooked. Eleven of the fifteen unbooked patients delivered at the tertiary unit, two patients delivered at secondary hospitals, one patient delivered at the midwife obstetric unit and one unbooked patient delivered at home.

TABLE 3. PAST AND CURRENT PREGNANCY COMPLICATIONS

PAST PREGNANCY COMPLICATIONS	**NUMBER = 109 (primigravidas excluded)**	**%**
Previous caesarean section	**27**	**24.8 %**
Previous uterine surgery	**3**	**2.8 %**
Postpartum haemorrhage	**3**	**2.8 %**
Multiple pregnancy	**2**	**1.8 %**
Previous stillbirth	**6**	**5.5 %**
Previous pelvic surgery	**2**	**1.8 %**
Previous abruptio placenta	**2**	**1.8 %**
CURRENT PREGNANCY		

COMPLICATIONS	Number = 145	
Anaemia	**27**	**18.6 %**
Multiple pregnancy	**12**	**8.3 %**
Placenta praevia	**15**	**10.3 %**
Pre-eclampsia	**30**	**20.7 %**
Antepartum haemorrhage	**34**	**23.4 %**
Malpresentation	**10**	**6.9 %**
Eclampsia	**2**	**1.4 %**
Prolonged pregnancy	**9**	**6.2 %**
Diabetes / Impaired glucose tolerance	**3**	**2.1 %**

In this study it was found that a history of previous caesarean sections was the most frequent past obstetric complication (24.8 %). Previous pelvic surgery referred to procedures for ectopic pregnancies and previous ovarian cyst drainage. All these procedures could contribute to excess scar formation and adhesions resulting in more difficult surgery in a future pregnancy.

Pre-eclampsia (20.7 %) and antepartum haemorrhage (23.4 %) were the most common complications in the current pregnancy associated with obstetric haemorrhage. Anaemia was noted in 18.6 % of patients (Table 3).

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TABLE 4. LABOUR AND DELIVERY DETAILS OF WOMEN WITH SEVERE OBSTETRIC HAEMORRHAGE

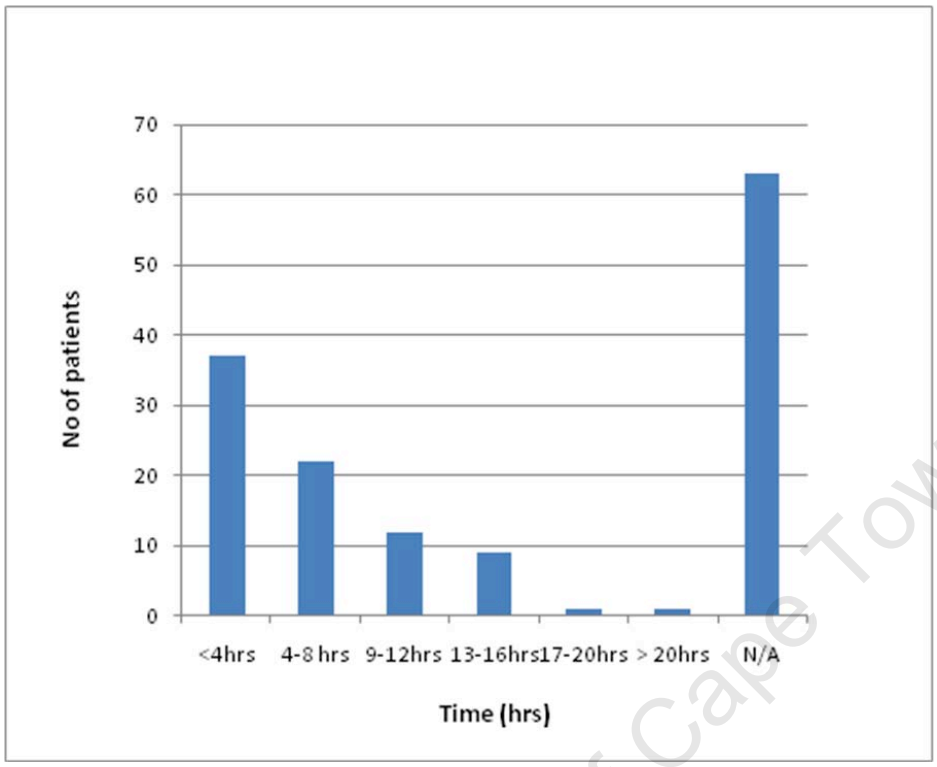
LABOUR DETAILS	NUMBER = 145	%
Successful normal vaginal deliveries	**27**	**18.6 %**
Successful Inductions of labour	**37**	**25.5 %**
Elective caesarean section	**21**	**14.5 %**
Emergency caesarean section	**60**	**41.3 %**

Of the 145 patients 81 patients had caesarean sections or laparotomies.There was 21 patients (14.5%) who had elective caesarean sections whereas 60 patients (41.3%) had emergency caesarean sections. Five of the women that had emergency caesarean sections (8.3%) followed inductions of labour whereas the remaining 55 patients (91.7 %) presented in spontaneous labour as shown in Table 4. Fourteen of the 37 women who were induced received misoprostol. Many of the women had placental abruptions and artificial rupture of the membranes and oxytocin were used to establish labour.

FIGURE 2

DURATION OF ACTIVE

LABOUR

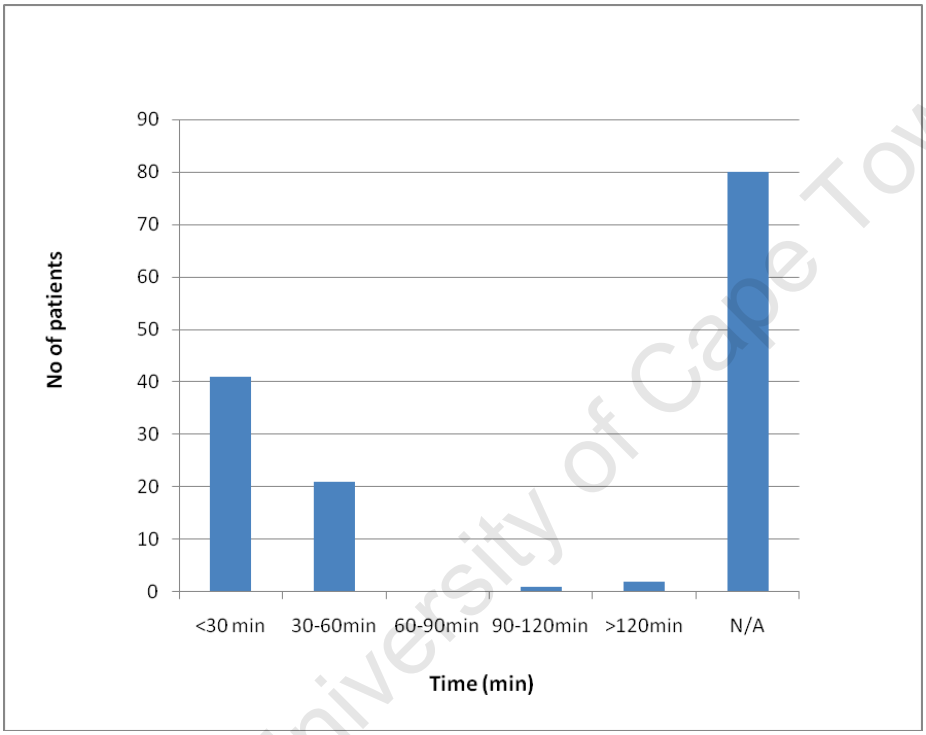


As a prolonged labour contributes to obstetric haemorrhage especially postpartum haemorrhage, we assessed the duration of active labour as part of our quality of care audit. In 37 patients active labour was no longer than 4hours.The duration of active labour ranged between 13-16 hours in 9 patients whereas only one patient had active labour between 17-20 hours and one patient was allowed to be in active labour for more than 20 hours.Hence 11 patients (13.4 % of 82 patients) experienced a prolonged labour (Figure 2). Sixty three patients did not experience active labour either because they had

elective or emergency caesarean sections while in latent labour. Of the 82 patients that experienced active labour, only 49 patients required the use of a partogram as partograms were not used when patients were diagnosed with a placental abruption and an intra-uterine fetal death.

FIGURE 3

DURATION OF THE SECOND STAGE OF LABOUR

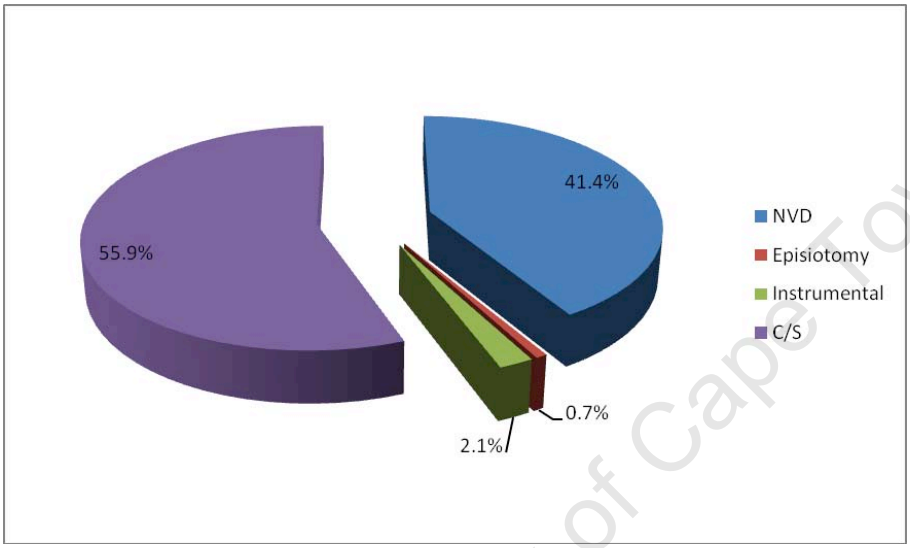


A delayed second stage of labour of greater than one hour contributes to postpartum haemorrhage. Only three patients in this study did have a prolonged second stage of

labour, 1 patient between 90-120 minutes and 2 patients experienced a second stage greater than two hours. Most patients had a second stage less than or equal to one hour (41 patients less than 30 minutes and 21 patients between 30-60 minutes) (Figure 3).

FIGURE 4

MODE OF DELIVERY



There were 64 patients who achieved vaginal delivery. Of these 60 had an uncomplicated normal delivery (41.4 % of 145 patients), 1 patient (0.7 %) had an episiotomy, 3 patients had assisted instrumental deliveries (2.1 %). Caesarean sections occurred in 81 patients (55.9%) as shown in Figure 4.

TABLE 5.CAUSES OF OBSTETRIC HAEMORRHAGE IN THE PMNS HOSPITALS

CAUSES OF OBSTETRIC HAEMORRHAGE	NUMBER N=145	%
Atonic uterus	**37**	**25.5 %**
Abruptio placenta –with hypertension	**24**	**16.6 %**
Abruptio placenta – no hypertension	**16**	**11 %**
Retained placenta	**21**	**14.5 %**
Placenta accreta	**4**	**2.8 %**
Placenta praevia	**16**	**11.0 %**
Ruptured uterus	**7**	**4.8 %**
Difficult caesarean sections	**20**	**13.8 %**

Table 5 shows that the most common cause of haemorrhage was abruptio placenta (40 cases, 27.6 %), followed by uterine atony (37 cases, 25.5 %), retained placenta (21 cases, 14.5 %), and difficult caesarean sections (20 cases, 13.8 %).

There was considerable overlap in causes for the cases but we chose the primary cause of haemorrhage, for example if uterine atony followed an abruptio placenta, it was classified as abruptio placenta.

Of note is that there were 74 cases which were associated with caesarean sections (81 cases if the uterine ruptures are included) and 4 genital tract lacerations associated with the above causes.

The 74 cases associated with caesarean sections often would have had another primary cause of the obstetric haemorrhage, for example bleeding due to uterine atony at surgery for prolonged labour or lower segment bleeding at caesarean section for placenta praevia. Difficult caesarean sections in Table 5 referred to cases with difficult abdominal entry, excess scar formation or bleeding secondary to trauma.

TABLE 6.ESTIMATED BLOOD LOSS

ESTIMATED BLOOD LOSS	**NUMBER N=145**	**%**
1000-1499 ml	**104**	**71.7 %**
1500-1999 ml	**20**	**13.8 %**
2000-2499 ml	**12**	**8.3 %**
2500-2999 ml	**4**	**2.8 %**
> 3000 ml	**5**	**3.4 %**

Only 3.4 % of patients had an estimated blood loss in excess of 3 litres whereas the majority of patients (71.7 %) had an estimated blood loss below 1.5 litres (Table 6).

During resuscitation all 145 patients received intravenous fluids, 90 patients (62.1 %) received blood and 42 patients (29 %) received fresh frozen plasma.

TABLE 7.LIST OF TREATMENT PROVIDED TO WOMEN WITH SEVERE OBSTETRIC HAEMORRHAGE

TREATMENT MODALITIES	**NUMBER**	**%**
Oxytocin infusion	**103**	**71 %**
Ergometrine	**27**	**18.6 %**
Misoprostol	**75**	**51.7 %**
Prostaglandin F2 alpha	**5**	**3.4 %**
B – Lynch suture	**6**	**4.1 %**
Haemostatic sutures	**51**	**35.2 %**
Manual removal of placenta	**18**	**12.4 %**
Evacuation of uterus	**17**	**11.7 %**
Intra-uterine catheter	**5**	**3.4 %**
Repair of perineal tears	**4**	**2.8 %**
Uterine surgical repair	**5**	**3.4 %**
Sub/Total abdominal hysterectomy	**2**	**1.4 %**
No pharmacological treatment	**5**	**3.4 %**

It is interesting to note that ergometrine was only used in 18.6 % of patients and that 5 patients received no treatment at all.

TABLE 8.MATERNAL AND FETAL OUTCOMES IN WOMEN WITH SEVERE OBSTETRIC HAEMORRHAGE

OUTCOME	**NUMBER N=145**	**%**
Healthy mother and baby	**104**	**71.7 %**
Stillbirths	**35**	**24.1 %**
Maternal death	**3**	**2.1 %**
Maternal morbidity	**3**	**2.1%**

There were three maternal deaths during our study. The first death was secondary to eclampsia complicated by pulmonary oedema and the second death was a result of pre-eclampsia with an intracerebral bleed. The third death was a direct result of obstetric haemorrhage, namely uterine rupture in a grand multiparous patient.Two of the maternal deaths occurred at the tertiary hospital and the third occurred at the secondary hospital.

The case fatality rate with regards to obstetric haemorrhage was 0.69 %.

There were two patients who had total abdominal hysterectomies at the tertiary hospital. There was one patient who required ventilation in our study (also at the tertiary unit). There were 35 stillbirths; all were secondary to placental abruptions and all the deliveries occurred at the tertiary hospital.

QUALITY OF CARE ASSESSMENT OF MANAGEMENT OF OBSTETRIC HAEMORRHAGE

ANTENATAL CARE

Of the 130 booked patients (89. 7% of 145 patients), one patient (0.77 %) did not have her haemoglobin checked at booking. Fifteen patients (10.3%) were unbooked. Sixteen of the 130 booked patients (12.3%) had their haemoglobin retested at 32 weeks.

During admission in labour or prior to elective caesarean section or induction of labour, 86 patients (59.3 % of 145 patients) had their blood tested for haemoglobin on admission.

Haematinics: 21 patients (14.5 %) had prophylactic haematinics prescribed antenatally.

TABLE 9.ANTENATAL MANAGEMENT AND ASSESSMENT

TREATMENT OF ANAEMIA N=27	**NUMBER**	**%**
Selective haematinics	**16**	**59.3 %**
Blood transfusion	**3**	**11.1 %**
No treatment	**8**	**29.6 %**
APPROPRIATE		

DELIVERY PLAN N = 130		
Yes	**125**	**96.2 %**
No	**5**	**3.8 %**

There were 27 patients who were anaemic with haemoglobin less than 10. Of these patients 8 (29.6 %) did not receive selective haematinics or blood (Table 9).

It was found that only 5 of 130 booked patients (3.8 %) did not have an appropriate delivery plan. An appropriate delivery plan refers to assigning the correct level of care for delivery, for example a woman with a previous caesarean section or current multiple pregnancy would have a plan made for delivery in a hospital.

INTRAPARTUM CARE

There were 72 patients that were referred to secondary or tertiary hospitals intrapartum. Of these patients 63 (87.5 %) were appropriately referred according to the PMNS protocol whereas 9 patients (12.5%) were inappropriate referrals. These 9 referrals were recognised as high risk but incorrectly referred to a secondary level instead of a tertiary hospital. All 9 referrals were redirected to the appropriate level of care. Only in one of these 72 patients (1.4 %) risk factors were not identified and there was no plan for referral initially.

TABLE 10.USE OF PARTOGRAM

PARTOGRAM USED N=49	NUMBER	%
Yes	**48**	**98 %**
No	**1**	**2 %**
APPROPRIATE INTERVENTION ON PARTOGRAM N=48		
Yes	**44**	**91.7 %**
No	**4**	**8.3 %**

Only 49 patients reached active labour and hence required the use of a partogram. In one of these patients the partogram was not used. The use of the partogram did not apply in 96 patients. The partogram was only started when patients reached active labour ie.3cm dilated and fully effaced. Hence partograms were not used when patients were induced or presented in latent labour and an emergency caesarean section was performed prior to active labour. Also partograms did not apply when patients awaited elective caesarean sections.

Oxytocin was used for augmentation in 38 patients and misoprostol was used for the induction of labour in 14 patients and these drugs were all used in the correct dosages.

We were unable to comment on whether the active management of the third stage was used intrapartum as this was not documented in the delivery notes.

MANAGEMENT OF THE ACUTE EVENT

TABLE 11.DIAGNOSIS AND INITIAL RESUSCITATION

TIME FROM DELIVERY TO DIAGNOSIS OF OBSTETRIC HAEMORRHAGE	**NUMBER N=145**	**%**
<15 min	**101**	**69.7 %**
15-29 min	**29**	**20 %**
30-59 min	**10**	**6.9 %**
60-119 min	**4**	**2.8 %**
2-3 hrs	**1**	**0.6 %**
TIME FROM OBSTETRIC HAEMORRHAGE DIAGNOSIS TO IV LINES AND RINGERS LACTATE		
Not done	**1**	**0.7 %**
Pre-operatively	**63**	**43.4 %**
<15 min	**71**	**49 %**
15-29 min	**5**	**3.4 %**

30-59 min	**4**	**2.8 %**
60-120 min	**1**	**0.7 %**

Seventy two patients (49.7 %) had only one intravenous line inserted and one patient (0.7 %) did not have any intravenous access.

TABLE 12.USE OF BLOOD TRANSFUSION

TIME FROM HAEMORRHAGE DIAGNOSIS TO EMERGENCY BLOOD (O negative)	**NUMBER**	**%**
Not done	**65**	**44.8 %**
<15 min	**1**	**0.7 %**
15-29 min	**8**	**5.5 %**
30-59 min	**6**	**4.1 %**
60-119 min	**3**	**2.1 %**
2 hrs-2 hrs 59 min	**4**	**2.8 %**
3-5 hrs	**1**	**0.7 %**
> 5 hrs	**53**	**36.6 %**
Before delivery	**4**	**2.7 %**

TIME FROM HAEMORRHAGE DIAGNOSIS TO CROSSMATCHED BLOOD		

Not done	**5**	**3.4 %**
<15 min	**2**	**1.4 %**
15-29 min	**7**	**4.8 %**
30-59 min	**4**	**2.8 %**
60-119 min	**12**	**8.3 %**
2 hrs-2 hrs 59 min	**12**	**8.3 %**
3-5 hrs	**13**	**9 %**
>5 hrs	**37**	**25.5 %**
Not applicable	**53**	**36.5 %**

It was noted that 53 patients (36.6 %) received emergency blood only after five hours. It is important to remember that many of these patients were referred from midwife obstetric units where blood is not available. Hence the delay in receiving blood was often secondary to awaiting transport to the next level of care and further assessment by the doctor there.

A senior doctor referred to a specialist consultant in obstetrics. In 75.2 % of cases a senior doctor was not called on site for assistance.

TABLE 13.SPECIALIST INVOLVEMENT IN MANAGEMENT

TIME ELAPSED BEFORE SENIOR DOCTOR CALLED	NUMBER	%
Not done	**109**	**75.2 %**
<15 min	**14**	**9.7 %**
15-29 min	**12**	**8.3 %**
30-59 min	**8**	**5.5 %**
60-119 min	**1**	**0.7 %**
2-3 hrs	**1**	**0.7 %**

Most cases were managed by an on- site registrar. The registrar could liaise with the consultant telephonically for advice and would call the consultant for help if needed. The senior doctor (consultant) was called to be present when assistance was required. In one case (0.7 %) help was requested only after 2-3 hours.

REFERRALS

There were 72 patient referrals however the total transfers equal 84 as some patients were referred to the inappropriate level and needed further transfer and a few patients were

referred appropriately to a secondary hospital but their condition deteriorated and they then required transfer to a tertiary level of care.

TABLE 14.DETAILS OF WOMEN REFERRED

APPROPRIATE REFERRAL		**NUMBER N=84**	**%**
Primary to secondary hospital	**Yes**	**41**	**82 %**
	No	**9**	**18 %**
Secondary to tertiary hospital	**Yes**	**21**	**100 %**
	No	**0**	**0**
Primary to tertiary hospital	**Yes**	**13**	**100 %**
	No	**0**	**0**

There were 9 inappropriate referrals (18 %) from a primary to a secondary level of care and these patients were redirected to the next level of care. There were no inappropriate referrals to the tertiary hospital. This could be secondary to the fact that all referrals to Groote Schuur Hospital have to be triaged and accepted by a senior registrar. The referrals were not all for obstetric haemorrhage but rather for all indications requiring care at a secondary or tertiary hospital for example slow progress or pre-eclampsia. Many of these patients only experienced the obstetric haemorrhage once at the next level of care.

TABLE 15.REFERRALS – ARRIVAL TIMES

TIME FROM REFERRAL TO ARRIVAL AT NEXT LEVEL	**NUMBER**	**%**
Primary to secondary N=50		
15-29 min	**2**	**4 %**
30-59 min	**1**	**2 %**
60-119 min	**17**	**34 %**
2 hrs-2 hrs 59 min	**14**	**28 %**
3-5 hrs	**9**	**18 %**
>5hrs	**1**	**2 %**
Unknown	**6**	**12 %**
Secondary to tertiary N=21		
30-59 min	**2**	**9.5 %**
60-119 min	**8**	**38.1 %**
2 hrs-2 hrs 59 min	**8**	**38.1 %**
3-5 hrs	**1**	**4.8 %**
>5hrs	**1**	**4.8 %**

Unknown	**1**	**4.8 %**
Primary to tertiary N=13		
30-59 min	**1**	**7.7 %**
60-119 min	**7**	**53.8 %**
2 hrs-2 hrs 59 min	**1**	**7.7 %**
3-5 hrs	**2**	**15.4 %**
>5 hrs	**1**	**7.7 %**
Unknown	**1**	**7.7 %**

When analysing the time periods from the decision to refer to arrival times, with regard to transport, there were few cases, one at each level which took longer than five hours to arrive at the appropriate hospital. The majority of referrals took between one to three hours.

The following section assesses management of the different causes of obstetric haemorrhage. For this section, 43 cases of uterine atony are considered (They included 30 cases of uterine atony following abruptio placenta as well as the 13 cases of uterine atony).

TABLE 16 – MANAGEMENT OF UTERINE ATONY

TOTAL	**43**	**100 %**
Correct diagnosis made	**43**	**100 %**
Time from diagnosis to IV oxytocin infusion		
<15 min	**37**	**86 %**
15-29 min	**2**	**4.7 %**
30-60 min	**2**	**4.7 %**
Not done	**2**	**4.7 %**
No response of oxytocin to use of :		
Misoprostol		
< 15 min	**19**	**44.2 %**
15-29 min	**7**	**16.3 %**
30-59 min	**2**	**4.7 %**
60-119 min	**2**	**4.7 %**
2-3 hrs	**1**	**2.3 %**
Not Done	**12**	**27.9%**
Ergometrine		
<15 min	**5**	**11.6 %**
15-30 min	**1**	**2.3 %**

>5 hrs	**1**	**2.3 %**
Not done	**36**	**83.7 %**
Conservative surgical management		
B-Lynch	**0**	**0 %**
Uterine artery ligation	**0**	**0 %**
Time to total abdominal hysterectomy	**N/A**	**N/A**
Not done	**43**	**100 %**

It is interesting to note that in most cases uterine atony responded to drugs such as oxytocin , misoprostol and the less frequently used ergometrine (possibly secondary to the large percentage of women with pre-eclampsia). During our study there was no conservative surgical management or hysterectomies required to manage uterine atony. In addition there was no balloon tamponade technique used.

TABLE 17 – MANAGEMENT OF RETAINED PLACENTA

TOTAL	**21**	**100 %**
Correct diagnosis	**21**	**100 %**
Time from delivery to making correct diagnosis		
<15 min	**4**	**19 %**
15-29 min	**6**	**28.6 %**
30-59 min	**9**	**42.9 %**
60-119 min	**1**	**4.8 %**
2-3 hrs	**1**	**4.8 %**
Time from diagnosis to manual removal of placenta		
Delivered in hospital N=5		
15-29 min	**2**	**40 %**
30-59 min	**1**	**20 %**
60-119 min	**1**	**20 %**
2-3 hrs	**1**	**20 %**
Delivered in MOU and referred to hospital N=15		
60-119 min	**6**	**40 %**
2 hrs-2 hrs 59 min	**6**	**40 %**

3-5 hrs	**3**	**20 %**
Time from diagnosis to IV oxytocin infusion		
<15 min	**18**	**85.7 %**
15-29 min	**2**	**9.5 %**
30-60 min	**1**	**4.8 %**
Time from diagnosis to obstetrician made aware of patient		
15-29 min	**2**	**9.5 %**
30-59 min	**4**	**19 %**
60-119 min	**6**	**28.6 %**
2 hrs-2 hrs 59 min	**7**	**33.3 %**
3-5 hrs	**2**	**9.5 %**
Time from diagnosis to arrival of anaesthetist		
<15 min	**5**	**23.8**
15-29 min	**4**	**19**
30-59 min	**4**	**19**
60-119 min	**1**	**4.8**
2-3 hrs	**1**	**4.8**
>5hrs	**1**	**4.8**
Not applicable	**5**	**23.8**

In 9 of our 21 patients (42.9 %) with a retained placenta the diagnosis was made within thirty to sixty minutes from the time of delivery and 85.7 % of patients received an oxytocin infusion within 15 minutes of the diagnosis. The " time to the obstetrician being made aware of the patient" referred to the time from diagnosis by the midwife, either in hospital or at the MOU, to informing the obstetrician. Five patients did not require a manual removal of the placenta in a theatre and one patient did not require a manual removal at all as the placenta was no longer retained on arrival at the next level of care. The differences in time between this procedure occurring in a patient who delivers at the hospital and a patient referred from a MOU is obviously secondary to the time taken for the patient to be transported to the appropriate level of care (table 17).

During our study period there were no cases of obstetric haemorrhage secondary to cervical tears.

TABLE 18 – MANAGEMENT OF UTERINE RUPTURE

TOTAL	**7**	**100%**
Correct diagnosis		
Yes	**1**	**14.3 %**
No	**6**	**85.7 %**
Time from diagnosis of intra-partum bleeding to diagnosis of uterine tear		

<15 min	**1**	**14.3 %**
60-120 min	**1**	**14.3 %**
Diagnosed in theatre	**5**	**71.4 %**
Time from diagnosis of haemorrhage to arrival of anaesthetist		
Diagnosed in theatre	**7**	**100 %**
Time from diagnosis of haemorrhage to surgical intervention		
<15 min	**2**	**28.6 %**
15-29 min	**2**	**28.6 %**
30-59 min	**2**	**28.6 %**
60-120 min	**1**	**14.3 %**
Time from failed conservative management to total abdominal hysterectomy		
<15 min	**1**	**14.3 %**
Not applicable /uterus repaired	**6**	**85.7 %**

There were seven uterine ruptures and of these two occurred at the tertiary hospital whereas the other five occurred at the secondary hospitals.

Only one uterine rupture was diagnosed correctly and unfortunately this case resulted in a maternal death. The patient was a multiparous patient (five previous normal vaginal deliveries) who presented with precipitous labour, then became bradycardic and hypotensive. She was in theatre within fifteen minutes; however cardio-respiratory arrest occurred intra-operatively and the patient did not respond to resuscitation. All the other cases were diagnosed in theatre at laparotomy / caesarean section.

One patient had a total abdominal hysterectomy. This particular patient was referred from a MOU with slow progress but the decision for a caesarean section was only made eight hours after her arrival at the next level. She had a caesarean section but deteriorated while in the recovery room and was taken back to theatre 120 minutes later where a ruptured uterus was identified and a hysterectomy performed immediately. In all the other cases the ruptured uterus was repaired.

Three cases were taken to theatre for caesarean sections in view of fetal distress and uterine ruptures were diagnosed intra-operatively. Of these, one patient had not communicated that she had had a previous myomectomy. This was secondary to a language barrier (French –speaking).

Only one case of uterine rupture involved induction of labour with appropriate dosages of misoprostol and pitocin in a nulliparous patient. The decision for caesarean section was

made in view of failure to progress however there was a four hour delay in the patient going to theatre.

The last case occurred in a patient who had had a previous caesarean section and she presented with an antepartum haemorrhage and an intra-uterine fetal death. This was assumed to be secondary to an abruptio placenta, however intra-operatively a rupture was diagnosed. This patient was initially allowed to labour but was taken to theatre for slow progress.

Table 19 evaluates the management of caesarean section associated haemorrhage. The total number was 74 and includes difficult surgery as well as women with other conditions causing bleeding at caesarean section.

TABLE 19 – MANAGEMENT OF CAESAREAN SECTION ASSOCIATED HAEMORRHAGE

TOTAL	**74**	**100 %**
Intra-op	**74**	**100 %**
Post-op	**0**	**0 %**
Time to re-look laparotomy		
>5 hrs	**1**	**1.4 %**
Time to using:		
Oxytocin		

<15 min	**29**	**39.2 %**
15-29 min	**12**	**16.2 %**
30-60 min	**3**	**4.1 %**
2-3 hrs	**1**	**1.4 %**
Not used	**29**	**39.2 %**
Misoprostol		
<15 min	**2**	**2.7 %**
15-29 min	**9**	**12.2 %**
30-59 min	**18**	**24.3 %**
60-119 min	**4**	**5.4 %**
2-3 hrs	**1**	**1.4 %**
Not used	**40**	**54.1 %**
Ergometrine		
<15 min	**7**	**9.5 %**
15-29 min	**7**	**9.5 %**
30-60 min	**4**	**5.4 %**
Not used	**56**	**75.7 %**
Prostaglandin F2 alpha		
15-29 min	**3**	**4.1 %**
30-60 min	**2**	**2.7 5**
Not used	**69**	**93.2 %**
B-Lynch suture		

30-60 min	**6**	**8.1 %**
Not used	**68**	**91.9 %**
Total abdominal hysterectomy		
60-120 min	**1**	**1.4 %**
Not done	**73**	**98.6 %**

All of the obstetric haemorrhage associated with caesarean section occurred intra-operatively. Most were managed with uterotonic agents and haemostatic sutures and 6 had insertion of a B-Lynch suture. Only one patient had a relook laparotomy (1.4 %). She had had an emergency caesarean section because she presented in labour with a breech presentation. The procedure was difficult and haemostatic sutures were used intra-operatively. A re-look laparotomy was performed as there was concern regarding a drop in haemoglobin. No bleeding was found at the second procedure and she was transfused with three units of packed cells.

One patient with caesarean-associated haemorrhage had a total abdominal hysterectomy. It was an elective caesarean section because of a major degree placenta praevia. The bleeding from the lower segment could not be controlled with haemostatic sutures and the decision was made by a specialist consultant to proceed to a hysterectomy within 60-120 minutes.

The 145 cases in our study were then reviewed according to the checklist derived from national guidelines (appendix 3). The total number of points equalled 30 however if certain points were not relevant to a case the denominator would change. We scored the management of each case with the appropriate denominator and assigned a percentage to each case. In our study 114 patients received adequate management, whereas 30 patients received intermediate and 1 patient received suboptimal care.

TABLE 20.QUALITY OF CARE SCORE ASSIGNED TO CASES

SCORE	NUMBER OF CASES
90-100 %	6
80-89 %	46
70-79 %	62
60-69 %	24
50-59 %	6
40-49 %	1
TOTAL	145

DISCUSSION

Obstetric haemorrhage still remains a significant cause of maternal mortality and morbidity, especially so in developing countries, where 99 % of all maternal deaths occur. During the time period August 2006 to August 2007 we retrieved 145 cases that met the criteria for our study giving a rate of 3.7 per 1000 deliveries. It was found that pre-eclampsia (20.7%) and antepartum haemorrhage (23.4%) were the most common complications in the current pregnancy whereas a history of previous caesarean sections was the most frequent past obstetric complication. Many of the women who had pre-eclampsia in the current pregnancy also had placental abruptions.

We found that placental abruptions were the most common cause of obstetric haemorrhage (27.6 %) followed by uterine atony (25.5 %). It is important to note that although only 20 cases were secondary to difficult or traumatic caesarean sections, 74 cases overall were associated with caesarean sections and there was considerable overlap; these included intra-operative haemorrhage due to other primary causes such as uterine atony or placenta praevia.

The quality of management of the 145 cases was scored according to a checklist derived from the national guidelines. We found that 114 patients (78.6 %) received adequate care (between 70-100%), 30 patients (20.7 %) received intermediate care (between 50-70%) and 1 patient (0.7 %) received suboptimal care (below 50%). We analysed the quality of

care by assessing each individual case. Another meaningful method would be to assess care at the various levels for example the midwife-led units, secondary and tertiary units. In this study it was difficult to assess care according to the different levels as many patients accessed all levels of care.

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There was only one maternal death directly due to obstetric haemorrhage and the case fatality ratio in our study was 0.69 %. This is acceptable as it is below the maximum of 1 % as recommended by the United Nations (WHO) in 1997 .The case fatality ratio is a process indicator of the utilisation and quality of emergency obstetric services [21].

There was one patient who required admission to ICU and ventilation and 2 patients had total abdominal hysterectomies. Severe maternal morbidity or near misses refer to an acute obstetric event that immediately threatens the survival of a woman but does not result in her death either by chance or by the hospital care she receives [22]. There is controversy regarding the cases that are included for example Mantel et al includes all cases with system dysfunction or failure whereas Filippi applies the disease-specific criteria [23, 24].

The limitations of our study were as follows:

1. The folders were reviewed retrospectively.
2. Blood loss is often underestimated. We used cases where blood loss was documented in the delivery registers and computer programs as greater than or equal to 1000 ml. It is possible that many cases were missed as blood loss was underestimated.

3. New Somerset hospital did not record blood loss in their delivery and theatre registers .We thus relied on registrars to inform us of patients who fulfilled the requirements for the study. The total of 145 patients may thus be an underestimate of patients with severe obstetric haemorrhage during the period of our study.

4. The checklist devised could be seen as preliminary since it was constructed by the researcher and supervisor, and was not subject to consensus from an expert panel as in the French criterion based audit. The categorisation of scores into adequate, intermediate and suboptimal was arbitrary and needs to be validated further.

5. Our study design could have missed some maternal deaths if the deceased women did not access the health care facilities. We did not search local databases of maternal deaths.

During this study it was found that 50.3 % of deliveries associated with obstetric haemorrhage occurred at a tertiary hospital. This could be a reflection of a satisfactory referral system where more high risk patients are referred to Groote Schuur hospital before delivery. This is substantiated by the finding that pre-eclampsia (20.7 %) and antepartum haemorrhage (23.4%) were the most common complications in the current pregnancies in this study.

The pattern of causes of obstetric haemorrhage varies widely in different populations. In our study placental abruptions (27.6 %) were the leading cause of obstetric haemorrhage followed by atony which accounted for 25.5 % of cases. This differs from the Scotland study where uterine atony predominated as the cause of haemorrhage (48.4 %). It is interesting to note that placental abruptions only accounted for 9.3 % of cases in the Scotland series [25].

In the Saving Mother's Report (2002- 2004) abruptions represented 39.6 % of maternal deaths secondary to antepartum haemorrhage. Postpartum haemorrhage resulting in mortality included uterine rupture accounting for 26.8%, uterine trauma (predominantly associated with caesarean sections) 24.9 % and uterine atony 23.6 % [(1)].

Emergency caesarean sections accounted for 41.4 % of deliveries. This equates with the Scotland study during the triennium 2003 -2005. When reviewing major obstetric haemorrhage in Scotland they found that 41 % of deliveries were emergency caesarean sections [(25)].

It is interesting that 14, 5 % of deliveries with obstetric haemorrhage in our study occurred in elective caesarean sections. This may be secondary to trauma as a result of adhesions from previous surgery or uterine atony as a consequence of overdistension on the basis of big babies or multiple pregnancies.

In our study B- Lynch sutures were only used on six occasions, all during caesarean section associated haemorrhage. Various other forms of compression including a specific haemostatic suturing technique for uterine bleeding during caesarean sections have been described [(26)].

The South African National Guidelines state that all women should be provided with iron supplementation in pregnancy. In the Peninsula Maternal and Neonatal Services, only 21

of the 145 patients (14.5%) received prophylactic haematinics. It is interesting to note that the Peninsula Maternal and Neonatal services only provides haematinics selectively according to their local policy and this may need to be re-evaluated. In eight patients (29.6%) anaemia was not detected and treated.

Most of the referrals were appropriate, only 18 % (9 referrals) were inappropriately referred to a secondary rather than a tertiary hospital. There were no inappropriate referrals to the tertiary level as all referrals to Groote Schuur Hospital have to be triaged by a senior registrar. There is also an ambulance transport infrastructure where the senior registrar at the tertiary hospital has to decide whether a case requires an ordinary or urgent ambulance or the flying squad.

The importance of the active management of the third stage of labour in preventing obstetric haemorrhage is not documented in this study as we are unable to comment due to poor documentation. It would be useful to evaluate this in a separate study.

It is also interesting that 49.7 % of patients had only one intravenous cannula inserted. The national guidelines recommend two large bore intravenous infusions in patients with features of shock. This may reflect poor training in resuscitation or underestimation of the amount of blood lost.

The evaluation of the quality of care for severe obstetric haemorrhage was previously reviewed in three French regions and published in 2001. Their checklist consisted of only

eight points which focused on the management of atony. The checklist focused on the time periods from haemorrhage recognition to a drug being administered and hence they assumed that the drug was always given [19]. They found that 62 % of patients received adequate care, 14 % received mixed care and 24 % received inadequate care. In the French study it was found that a lack of a 24 hour-on-site anaesthetist and a low volume of deliveries (<500 births per year) was associated with substandard care. This is very different to the Peninsula Maternal and Neonatal services where a secondary hospital may have 400 -500 deliveries per month. In the Scotland study most cases were assessed as well managed with suboptimal care identified in only 3 % of cases [25].

The checklist used in our study is preliminary and it was adapted from the South African National Guidelines. It is longer and wider ranging than that used in the French study and also states time periods for treatment. In our checklist we allowed for checking if a drug was administered prior to checking the time frames.

On reviewing the 145 cases in our study according to the checklist derived from national guidelines, it was found that 78.6 % (114 patients) received adequate care, 20.7 % (30 patients received intermediate care and 0.7 % (1 patient) received inadequate care. Since a different checklist was used, we cannot compare with the French or Scottish audits. It is also not useful to apply the French or Scottish criteria to our setting given the different circumstances in poorly resourced settings.

The use of a criterion based clinical audit may be a form of research which should be used more frequently particularly in developing countries where staff and resources are

limited. In this manner we are able to measure current practice against established criteria of good quality care, feedback and re-evaluate our management in a non-punitive manner [27].

The checklist we devised was easy to administer but needs to be used in other settings, for example in an area with a higher maternal mortality rate in relation to obstetric haemorrhage. It would also be useful to have it reviewed by a team of experts and be properly validated for use in poorly resourced settings.

This audit revealed many strengths for example an effective referral system and good emergency management by the referral hospitals. However, many deficiencies were also revealed in this study which needs to be addressed as part of the audit loop.

Recommendations

1. Continuing education (especially at the level of the midwife obstetric units) regarding detection and appropriate treatment of anaemia. In this audit treatment was not instituted in 29.6 % of anaemic patients.

2. All pregnant women should be given prophylactic haematinics as stated by the national guidelines.

3. Haemoglobin should be checked in all pregnant women when admitted in labour. Our audit found that only 59.3 % of patients had their haemoglobin checked in labour.

4. All medical personnel should be trained in resuscitation and acute management of obstetric haemorrhage. This training should be regularly revised and could be in the form of fire drills.

5. There should be feedback to all medical personnel regarding poor documentation. We were unable to comment on the third stage of labour in our study as it was often not recorded in the delivery notes.

6. Doctors should be trained to have a high index of suspicion for uterine rupture particularly with the following clinical scenarios:

- Previous caesarean section and antepartum haemorrhage especially if associated with intra-uterine fetal demise
- Non reassuring CTG traces as fetal heart rate changes may be the earliest sign if uterine rupture
- Sudden onset of maternal hypotension
- Prolonged labour particularly if no progress on the partogram

7. The hospitals of the PMNS should have a standardized method of record-keeping or the same computer program where blood loss is documented. During this study obstetric haemorrhage was probably underestimated as New Somerset hospital had a different computer program where blood loss beyond 999ml could not be documented and the delivery register did not document blood loss at delivery.

8. The checklist should be further evaluated in different settings and by other experts.

CONCLUSION

This audit revealed a rate of severe obstetric haemorrhage of 3.7 per 1000 deliveries and this is likely to be an underestimate.

In the Peninsula Maternal and Neonatal Services placental abruption (27.6 %) followed by uterine atony (25.5 %) were the most common cause of obstetric haemorrhage during the period August 2006 – August 2007. There was one maternal death directly as a consequence of haemorrhage with a case fatality ratio of 0.69 %. On reviewing the management of obstetric haemorrhage it was found that 78.6 % of patients received adequate care, 20.7 % received intermediate care and 0.7 % received inadequate care. Recommendations for improvements were made. The checklist needs to be tested in other settings and evaluated further by experts.

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APPENDIX 1
DEMOGRAPHIC DATA

1. Age
    < 20
    20 – 34
    >35

2. Gravidity

3. Parity

4. Marital status
    - married
    - other

5. Medical history
    - yes
    - no
    - specify
RVD status
CD4 count

6. History of severe obstetric complication
    - yes
    - no
Past…
Current…
Specify…

(Eg.prev C/S, previous uterine surgery, previous PPH, anaemia, multiparity,multiple pregnancy, polyhydramnios, placenta praevia, PET)

7. Place of delivery
    - MOU

- secondary hospital
- tertiary hospital
- other eg.BBA, ambulance

8. Labour
   - Spontaneous
   - induced
     Method ……
   - elective C/S
   - emergency C/S
     Reason ……

9. Length of labour - active 1st stage
   - 2nd stage

10. Delivery
    - NVD
    - episiotomy
    - assisted / instrumental delivery
    - C/S

11. Causes of PPH
    - atonic uterus
      Reason eg retained products, prolonged labour, uterine over distension
    - retained placenta
    - abruptio
      - with hypertension
      - without hypertension
    - placenta praevia
    - placenta accreta
    - ruptured uterus
    - genital tract laceration :
      Vaginal tear
      Perineal tear
      Cervical tear

Episiotomy
No cause specified

- post caesarean section bleeding
- inverted uterus

12. Estimated blood loss

13. Resuscitation: fluids given
-fluids
-blood
-FFP's

14. List treatment modalities

15. Outcome

APPENDIX 2

OBSTETRIC HAEMORRHAGE MANAGEMENT	Yes	No	<15 min	15-29min	30-59min	60-129min	2-3hrs	>5hrs	Not done
ANTENATAL									
Hb checked:-									
a) booking									
b) 32 weeks									
c) in labour									
Appropriate treatment of anaemia:-									
a) specify - prophylactic haemetenics									
b) selective haemetenics									
c) blood transfusion									
Appropriate delivery plan:-									
a) specify (risk factors recognized and plan for delivery									
……									
INTRAPARTUM									
a) referral from primary to secondary/tertiaty hospital as per protocol									
b) risk factors not recognized and no plan for referral									
c) partogram used									
d) appropriate intervention on line									
e) correct intrapartum doses of:									
oxytocin									
misoprostol									
MANAGEMENT OF ACUTE EVENT									
a) time from delivery to recognition/diagnosis of PPH									
b) time from PPH diagnosis to 2 IV lines and Ringers lactate									
c) time from PPH diagnosis to emergency blood									
d) time from PPH diagnosis to crossmatched blood									
e) time elapsed before senior doctor called									
REFERRALS									
a) appropriate referral:									
primary to secondary									
secondary to tertiary									
primary to tertiary									
b) time from referral to arrival at next level									
primary to secondary									
secondary to tertiary									
primary to tertiary									
UTERINE ATONY									
a) was correct diagnosis made immediately									
b) time from atony diagnosis to IV oxytocin infusion									
c) no response to oxytocin to use of misoprostol/ergometrine:									
specify which type									
if both given time difference									
d) conservative surgical management									
B Lynch suture									
uterine artery ligation									
e) no response to sugical intervention									
f) time from failed conservative surgery to TAH									
RETAINED PLACENTA									
a) was correct diagnosis made									
b) time to making correct diagnosis									
c) time from retained placenta diagnosis to manual removal:									
in hospital									
MOU to hospital									
d) diagnosis of retained placenta to IV oxytocin									
e) time from diagnosis to obstetrician made aware of patient									
f) time from diagnosis to arrival of anaesthetist									
CERVICAL TEAR									
a) was correct diagnosis made									
b) time from diagnosis of PPH to diagnosis of cervical tear									
c) time from diagnosis to arrival of anaesthetist									
d) time from failed repair to TAH									
UTERINE RUPTURE									
a) was correct diagnosis made									
b) time from diagnosis of PPH to diagnosis of uterine tear									
c) time from diagnosis to arrival of anaesthetist									
d) time from diagnosis to surgical intervention									
e) time from failed conservative surgery to TAH									
CAESARIAN SECTION ASSOCIATED HAEMORRHAGE									
a) intra-op bleeding									
b) post C/S bleeding									
c) time to re-look laparotomy									
d) time from recognition of bleeding to management									
oxytocin									
misoprostol									
ergometrine									
PG F2 alpha									
B lynch suture									
hysterectomy(consultant assistance)									

APPENDIX 3

SUGGESTED CHECKLIST FOR MANAGEMENT OF OBSTETRIC HAEMORRHAGE

	Yes	No	N/A
1.Haemoglobin checked			
2.Prophylactic haematinics given			
3.Antenatal anaemia detected / treated			
4.Delivery at appropriate level of care			
5.Partogram used			
6.Partogram acted upon appropriately			
7.Active management of the third stage			
8. Was haemorrhage recognized?			
9.Time from delivery/CS to recognizing haemorrhage < 30 min			
10.Doctor called / informed			
11.Time from recognition of haemorrhage to doctor called < 30 min			
12.IV line inserted			
13.Two IV lines			
14.Time from recognition of haemorrhage IV access <15 min			
15.Vital signs recorded (BP,pulse,urine output)			
16.Emergency blood given when Hb <7			
17.Time from haemorrhage recognition to blood given <45 min			
18.Cause of haemorrhage documented			
19.Cause of haemorrhage correctly identified			
20.Oxytocin infusion			
21.Time from haemorrhage recognition to to oxytocin infusion <15 min			
22.Second line agent (misoprostol,ergometrine) given if no response to oxytocin			
23.Time to administration of 2nd agent <30 min			
24.Patient taken to theatre if no response to medical treatment			

25.Time from failed medical management to theatre < 45 min			
26.Total abdominal hysterectomy done			
27.TAH done< 2 hrs from haemorrhage recognition			
28.Senior doctor available			
29.Referral to appropriate level of care			
30.Time taken from decision to refer to arrival at next level <2 hours			

SCORE = $\frac{\text{TOTAL NUMBER TICKED YES}}{\text{30 MINUS NUMBER OF BOXES MARKED N/A}}$ x 100 %